

RESPONSE OF SLASH PINE TO SEVERE CROWN SCORCH

By

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When you prescribe fire in a forest plantation, you normally do not plan to scorch the tree crowns. They contain the photosynthesizing tissues trees need to produce wood. Nevertheless, occasionally a fire gets more intense than you hoped it would, and the crowns of some trees are scorched. In a fire resistant species like slash pine, what are the consequences?

An experimental burn in a cooperative study by the Southern Forest Fire Laboratory and the Georgia Forestry Commission gave me the opportunity to answer that question. I didn't plan it that way. It just happened.

In the South, there is a great deal of interest in aerial ignition of prescribed burns because the number of burning days is limited and the acreage needing prescribed fire is huge. The Georgia Forestry Commission wanted to know how spot fires ignited like those that could easily be ignited from the air might behave in the palmetto-galberry fuel type. It was hoping to use the technique in the 35,000 acre Dixon Memorial State Forest in south Georgia.

PROCEDURE

For the experiment, we chose a 25-year-old slash pine plantation of some 72 acres. Trees were 55 to 65 feet tall, and basal area averaged about 70 square feet per acre. It had been 4 years since the previous hazard-reduction burn--a backfire.

Plots, of 4 1/2 to 15 acres were ignited during a 2-day period in late January 1982, when the National Fire Danger Rating Burning Index ranged from III to IV. Two weeks had elapsed since a rain and relative humidities ranged from 28 to 32 percent during the burning periods. Thus, surface litter was quite dry. Spacing of spot fire varied from 1 x 1 chain to 4 x 4 chains. Immediately after ignition of each plot, 6-7 of the spots were manned individually to record visual estimates, at timed intervals, of maximum flame height at the fire head and along the right flank. Flame height was used as a relative indicator of fire intensity in two active zones of the burn. ² Firing techniques and fire behavior are described in an earlier publication.

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² Johansen, R.W. - Prescribed burning with spot fires in the Georgia Coastal Plain. Georgia For. Res. Pap. 49. Macon, GA: Research Division, Georgia Forestry Commission; 1984. 7p.

In the early stages after ignition, the individual spot heads and flanks did not spread rapidly and flame heights varied from 3.5 to 5.5 feet. As the flames drew closer together, however, spread rates and flame heights increased sharply. Maximum flame heights exceeded 20 feet when neighboring headfires were merging with backfires or flanks were merging with each other.

Approximately 2 weeks after the plots were burned, a survey was made of how high needles were scorched (heat killed) in the tree crowns. The task was easy at this time because the scorched needles were brown but had not yet abscised from the branches. On each plot, four randomly selected, 20-foot-wide transects (two running north-south and two east-west) was examined. Many scorched and unscorched trees within the transects were measured with a Blume-Leiss altimeter to the topmost height of scorched needles and their locations recorded within the transect. When the entire tree crowns of dominant and codominant trees were scorched total tree height was listed as scorch height.

EFFECTS OF SCORCHING

An examination of the study plots after the first growing season showed there was absolutely no mortality, regardless of scorch level. But what of the growth loss?

During the spring of 1984, two growing seasons after the burns, breast-high increment cores were taken from 135 dominant and codominate trees. Of these, 103 had had 95 to 100 percent of their crowns scorched and 32 had had less than 10 percent. Each core was stored in a plastic drinking straw for later examination under a microscope back at the laboratory. Radial increment in the two seasons before the burn was compared to that in the two seasons after the burn.

Among trees that had suffered almost total crown scorch, the growth loss averaged 45 percent over the next two growing seasons. That, of course, is equivalent to the loss of 90 percent of a single year's growth. D.b.h. growth appeared normal in the trees that had suffered less than 10 percent crown scorch. Growth losses for the severely scorched trees are summarized by d.b.h. class in table 1. There appears to be no relation between the growth loss and the diameters of the trees.

Table 1. D.b.h. growth loss in the growing seasons after severe crown scorching in a 25 year old slash pine plantation.

<u>D.b.h. class</u> (Inches)	<u>Trees</u>	<u>D.b.h.</u> <u>growth loss</u>
	<u>Number</u>	<u>Percent</u>
6	7	41
7	28	53
8	35	43
9	26	43
10	<u>7</u>	<u>45</u>
Total	103	45

The pattern of diameter growth loss that occurred may be important. Sixty percent of the badly scorched trees formed neither a springwood nor a summerwood ring during the growing season after the burn, and 12 percent formed only a trace of a springwood ring together with a much reduced summerwood ring (Table 2). The remaining 28 percent of these trees had the normal number of growth rings, but ring width was reduced.

Table 2. D.b.h. growth response for two growing seasons after severe crown scorch.

<u>Growth response</u>	<u>Tree involved</u>	<u>2-year growth loss</u>
	<u>Percent</u>	<u>Percent</u>
1-ring ¹	60	53
1-ring + trace ²	12	46
2-rings ³	28	19

¹ One ring of springwood and one of summerwood

² Only a trace line of springwood parenchyma formed, 2-3 cells wide, followed by definite summerwood ring the first growing season and normal ring the second.

³ Normal ringwood deposition

CONCLUSIONS

If they have not been under unusual stresses from other sources, slash pines of pulpwood size and larger normally are not killed by crown scorching during the dormant season, but a growth loss must be anticipated. Results reported here show that the growth loss can be a full year's growth in the 2 years after the burn.

If total scorching occurs during the growing season, if the fire consumes needles, or if stem or root damage is incurred, tree mortality is more likely, and even greater growth losses among survivors must be anticipated.

I believe the results reported here are applicable to the major southern pines and to such other pines as red and ponderosa.